Naive Bayes (classification)

(loss measure: log likelihood
optimization method: MLE)

$$p(C_k \mid \underline{x}) \propto p(C_k) \prod_{j=1}^{M} p(x_j \mid C_k)$$

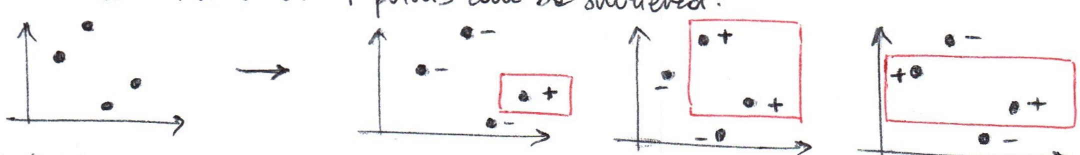
$$y(\underline{x}) = \arg\max_k \; p(C_k \mid \underline{x})$$

continuous variables: $p(x_j \mid C_k) = \mathcal{N}(\mu_{j_k}, \sigma_{j_k}^2)$, $p(C_k) = \frac{1}{K}$

	input → classes PERCEPTRON discriminant function	$\mathbb{P}(C_k \mid \underline{x})$ LOGISTIC REGRESSION probabilistic discriminative approach	likelihood $\mathbb{P}(\underline{x} \mid C_k)$ prior $\mathbb{P}(C_k)$ NAIVE BAYES probabilistic generative approach
Hypothesis space	$y(\underline{x}_n) = \text{sign}(\underline{w}^T \underline{x}_n)$	$y(\underline{x}_n) = \sigma(\underline{w}^T \underline{x}_n) = \frac{1}{1+e^{-\underline{w}^T \underline{x}_n}}$	$y(\underline{x}_n) = \arg\max \; p(C_k \mid \underline{x}_n)$
Loss measure	$L_p^{(\underline{w})} = -\sum_{n \in M} \underline{w}^T \underline{x}_n C_n$	$L(\underline{w}) = -\sum_{n=1}^{N} C_n \ln y_n + (1-C_n)\ln(1-y_n)$	log-likelihood
Optimization method	Online gradient-descent	gradient descent	MLE

VC dimension of an axis aligned rectangle is: $V(H) = 4$

1. prove that an instance of 4 points can be shattered:



2. prove that any instance of more than 4 points cannot be shattered: we start from the previous and we conclude that wherever we put the 5th point we have that the adversary can win

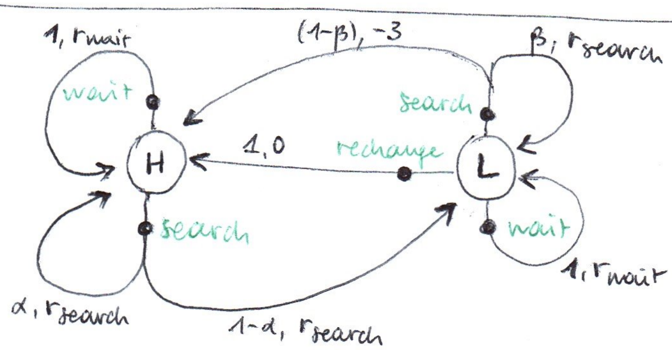
Kernel methods - Gaussian Process
kernel:

$$K(\underline{x}, \underline{y}) = \phi \, e^{-\frac{\|\underline{x}-\underline{y}\|_2^2}{2\ell^2}}$$

σ^2 = variance of the date (vertical scale, it affects ↕, the highest σ^2, the larger the bounds)

ℓ = bandwidth (the highest, the smoother the function, it's the horizontal scale)

ϕ = influence of the kernel on the result



$\alpha = 0.3$
$\beta = 0.5$
$\gamma = 1$
$r_{search} = 2$
$r_{wait} = 0$
$\pi(s \mid H) = 1$
$\pi(s \mid L) = 0.5$
$\pi(r \mid L) = 0.5$

Value function?

$$V_\pi(s) = \sum_{a \in A} \pi(a \mid s) \left[r(a,s) + \gamma \sum_{s' \in S} p(s' \mid s,a) V_\pi(s') \right]$$